RAPID SET CONCRETE PATCHING MATERIAL (MSP-02-01A)

1.0 Description. This specification covers cementitious materials that are suitable to repair concrete surfaces on bridges, particularly under fast setting or special conditions. The repair areas may include horizontal, vertical or overhead applications. The work shall consist of removing, furnishing, preparing, and placing materials at locations as shown on the plans or as directed by the engineer.

2.0 Material. All materials shall be in accordance with MoDOT specifications and as noted herein..

2.1 Aggregate For Extending Commercial Mixture. Coarse and fine aggregates shall be in accordance with Sec 1005, except the requirements for gradation and percent passing the No. 200 sieve shall not apply. Coarse aggregate meeting Gradation E requirements shall be used for repairs greater than 1" (25 mm) in depth. Fine aggregate will be allowed for repairs less than 1" (25 mm). Aggregate specified, bagged, labeled and furnished by the rapid set concrete patching material manufacturer may also be used for mortar extension.

2.2 Material Applications. The contractor shall select and use the product most suitable for the work and field conditions in accordance with these specifications.

2.3 Curing. Rapid set concrete patching material shall be cured until the minimum compressive strength is attained using standard curing specifications, unless otherwise specified by the manufacturer.

2.4 Qualification and Project Acceptance.

2.4.1 Inspection. All materials shall be subject to inspection and sampling by MoDOT at the source of manufacture, intermediate shipping terminal or destination. MoDOT shall be allowed free access to all facilities and records as required to conduct inspection and sampling.

2.4.2 Qualification. Prior to use, rapid set concrete patching material shall be qualified. In order to become qualified, a material shall have completed testing through AASHTO's National Transportation Product Evaluation Program (NTPEP). The manufacturer shall contact the AASHTO/NTPEP coordinator to obtain the testing location for the rapid setting concrete patching material. The coordinator may be contacted at the following telephone number (202) 624-5800.

2.4.2.1 The manufacturer shall submit with samples of the materials, a written request to Construction and Materials with the following information:

(a) Brand name of the product.

(b) Certification that the material meets this specification and is intended for use as described.

(c) NTPEP test results showing compliance in accordance with this special provision.

(d) Specific mixing, handling and curing instructions.

(e) Proper application type of the material (i.e., horizontal, vertical or overhead).

2.4.2.2 Upon approval by the engineer, the brand name and manufacturer will be placed on a qualified list of rapid set concrete patching materials. The listing of qualified materials is available from Construction and Materials or on MoDOT's web site. New certified test results and samples shall be submitted any time the manufacturing process or the material formulation is changed. The material will be subject to removal from the qualified list if there is evidence of unsatisfactory performance or a change in manufacturing process or formulation, or when random sampling and testing of material offered for use indicates nonconformity with any of the requirements herein specified.

2.5 Certification. The contractor shall supply a manufacturer's certification to the engineer for each lot of material furnished. The certification shall include the name of the manufacturer, a manufacturer certification statement that the material supplied is the same as that qualified and listing the date of qualification.

2.6 Acceptance. Acceptance of the material will be based on the use of a qualified material, the manufacturer's certification that the material supplied is the same as that qualified and upon the results of such tests as may be performed by the engineer.

3.0 Mixture. Unless otherwise specified, rapid set concrete patching material shall be approved commercial mixtures meeting Sections 3.1 – 3.1.3 or deck repair cementitious mortar meeting Section 3.2. Rapid set concrete patching materials shall be specifically designed for the application needed - horizontal, vertical or overhead repair.

3.1 Commercial Mixtures. Rapid set concrete patching material in its sacked form and mixtures when properly prepared in accordance with the manufacturer's specifications, shall meet the minimum test requirements given in Table 1. Mixtures may be supplied, as required, as a patching mortar or as a patching mortar with aggregate extension. If the material is to be supplied with extender aggregate, this shall also pass the required tests in Table 1 using the maximum allowed amount of extender aggregate.

3.1.1 Rapid set concrete patching material shall be single packaged dry mix requiring the addition of water or other liquid component just prior to mixing. The material shall be capable of ½" (13 mm) to full depth repair and require no bonding agent. The material shall not contain soluble chlorides as an ingredient of manufacture. The material shall be placed in accordance to the manufacturer's recommendations

Table 1
(English Unit)

Physical Test Property	Specification	Requirement for Horizontal application	Requirement for Vertical and/or Overhead application
Bond Strength by Slant Shear*	ASTM C882/C928 (1)	min. 1000 psi @ 24hrs.& min. 1500 psi @ 7 days	min. 1000 psi @ 24hrs.& min. 1500 psi @ 7 days
Linear Coefficient of Thermal Expansion* ** (for bagged mortar only, without extension aggregate)	ASTM C531	4 – 8 X 10-6 in/in/deg F	4 – 8 X 10-6 in/in/deg F
Resistance to Rapid Freezing & Thawing*	AASHTO T161 or ASTM C666	90% min. using Procedure B (300 Cycles)	90% min. using Procedure B (300 Cycles)
Compressive Strength*	AASHTO T22 or ASTM C39	3200psi @ 3 hr & 4000psi @ 7 days	1500psi @ 3 hr & 3000psi @ 24 hours

Table 1
(Metric Units)

Physical Test Property	Specification	Requirement for Horizontal application	Requirement for Vertical and/or Overhead application
Bond Strength by Slant Shear*	ASTM C882/C928 (1)	min. 6.9 MPa @ 24hrs.& min. 10.4 MPa @ 7 days	min. 6.9 MPa @ 24hrs.& min. 10.4 MPa @ 7 days
Linear Coefficient of Thermal Expansion* ** (for bagged mortar only, without extension aggregate)	ASTM C531	7.2 – 14.4 X 10-6 mm/mm/deg C	7.2 – 14.4 X 10-6 mm/mm/deg C
Resistance to Rapid Freezing & Thawing*	AASHTO T161 or ASTM C666	90% min. using Procedure B (300 Cycles)	90% min. using Procedure B (300 Cycles)
Compressive Strength*	AASHTO T22 or ASTM C39	22.1 MPa @ 3 hr & 27.6 MPa @ 7 days	10.4 MPa @ 3 hr & 20.7 Mpa @ 24 hours

*The commercial mix test values can be located in the AASHTO's National Transportation Product Evaluation Program (NTPEP) reports for Laboratory Evaluations of Rapid Set Concrete Patching Materials.
**Not required for extended mixtures if the mortar passes this requirement.
(1) ASTM C882 shall be performed on non-water based materials. ASTM C928 shall be performed on water-based materials.

3.1.2 The manufacturer shall provide with the bagged mixture, specifications for the mixing procedure, amount and kind of liquid to be added, and the amount of aggregate extension allowed, if any. All mixing, handling and curing practices recommended by the manufacturer shall be followed and will be considered a part of these specifications.

3.1.3 All mixtures shall be qualified before use. Any consistent failure of any mixture for any reason, material or application method, will be cause for removal from the qualified list.

3.2 Deck Repair Concrete. A qualified rapid set concrete patching material indicated for horizontal use and intended for patching concrete bridge decks may be used when specified on the plansand as approved by the engineer. If this option is selected, the contractor shall provide a trial mix to determine the total cure time needed to achieve a compressive strength of 3200 psi (22 MPa). Compressive specimens shall be prepared in accordance with current MoDOT test methods and cured to simulate actual field conditions. Testing of compressive specimens shall be performed by methods and at facilities acceptable to the engineer. The repaired deck shall not be opened to traffic until at least 4 hours after the last placement of deck repair concrete, the established cure time has elapsed and until such concrete has achieved a compressive strength of 3200 psi (22 MPa). A new trial mix may be required if the engineer determines the field conditions vary substantially from trial mix conditions. The engineer will make field cylinders to verify the 3200 psi (22 MPa) minimum strength.

4.0 Construction Requirements.

4.1 Mixing. Rapid set concrete patching material shall be mixed and finished according to the manufacturer's recommendation.

4.2 Concrete Removal. Deteriorated, damaged or defective concrete as shown on the plans, required by the specifications or as directed by the engineer, shall be removed. All exposed reinforcement shall be thoroughly cleaned as shown on the plans, required by the specifications or as directed by the engineer. Unless otherwise specified by the commercial mixture manufacturer, the existing surface shall be damp and all free water shall be removed prior to placement of the required material.

5.0 Method of Measurement. No measurement will be made for rapid set concrete patching material.

6.0 Basis of Payment. Rapid set concrete patching material will be paid for at the contract unit price for other items and will be considered full compensation for all labor, equipment and material to complete the described work.